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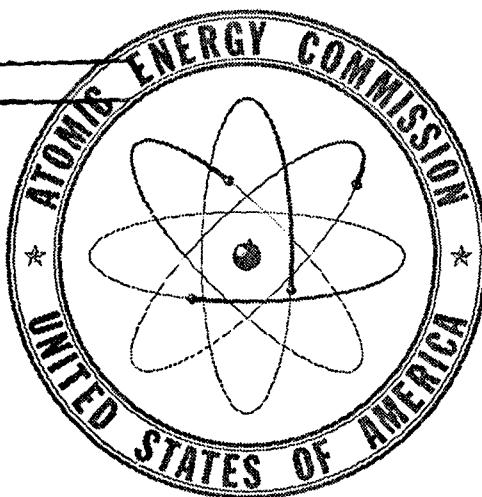
*Handbook of Federal Regulations applying to*

# Transportation of Radioactive Materials

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MAY 1958



*Handbook of Federal Regulations applying to*

# Transportation of Radioactive Materials

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UNITED STATES ATOMIC ENERGY COMMISSION  
DIVISION OF CONSTRUCTION AND SUPPLY  
TRAFFIC MANAGEMENT SECTION  
WASHINGTON, D. C.

20050913 008

## TABLE OF CONTENTS

### Chapter I.—INTRODUCTION

	Page
Purpose of Handbook.....	1
Purchase Source for Regulations.....	2

### Chapter II.—INTERSTATE COMMERCE COMMISSION REGULATIONS

#### Part 71.—GENERAL INFORMATION

Act of Congress (Penalty).....	6
Changes in Regulations.....	6
Export Shipments.....	7
Plan of Regulations.....	6
Public Hearings.....	7
Water, Transportation by.....	7

#### Part 72.—COMMODITY LISTS

Labeling and Prohibited Articles.....	8
Proper Shipping Name.....	8

#### Part 73.—REGULATIONS APPLYING TO SHIPPERS

Canadian Shipments.....	11
Classification of Dangerous Articles.....	9
Exemptions.....	10
Import and Export Requirements.....	11
Purpose of Regulations.....	8
U. S. Government Shipments.....	9
Violations and Accident Reports.....	12

#### Subpart A.—Preparation of Articles for Transportation

Empty Containers.....	12
Loading, Unloading, and Placarding of Cars.....	13
Rail Express Limitations.....	12

#### Subpart D.—Flammable Solids and Oxidizing Materials

Thorium Metal, Powdered.....	13
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#### Subpart G.—Poisonous Articles: Definition and Preparation

Cleaning and Decontamination of Cars and Vehicles.....	21
Exemptions for Radioactive Materials.....	15-16
Definitions.....	13-14
Labels for Radioactive Materials.....	20
Loading of Radioactive Materials into Cars and Trucks.....	21
Packing and Shielding.....	17-20

#### Subpart H.—Marking and Labeling of Explosives and Other Dangerous Articles

Bill of Lading Description.....	25
Certificate.....	26

	Page
Labeling .....	21-25
Label or Placard Notation .....	25
Marking of Packages Containing Dangerous Articles .....	21
 <b>Part 74—REGULATIONS APPLICABLE TO CARRIERS BY RAIL FREIGHT</b>	
Subpart A.—Loading, Unloading, Placarding, and Handling Cars	
Loading Other Dangerous Articles into Cars .....	26
Subpart C.—Placards on Cars	
Dangerous Articles Placards .....	27
Subpart D.—Unloading From Cars	
Cleaning Cars .....	28
Leakage from Packages .....	28
 <b>Part 76.—REGULATIONS APPLICABLE TO RAIL CARRIERS IN BAGGAGE SERVICE</b>	
Dangerous Articles .....	28
List of Acceptable Articles .....	29
 <b>Part 77.—REGULATIONS APPLICABLE TO MOTOR CARRIERS</b>	
Subpart A.—General Information and Regulations	
Application of Regulations .....	29
Labels .....	29
Marking and Placarding of Vehicles .....	29
Subpart B.—Loading and Unloading	
Blocking and Bracing of Radioactive Material .....	30
Location of Radioactive Shipments in Vehicles .....	30
Maximum number of units transported or stored .....	30
Subpart D.—Vehicles and Shipment in Transit: Accidents	
Part 77.860.—Accidents; Poisons	
Subpart E.—Regulations Applying to Explosives or Other Dangerous Articles on Motor Vehicles Carrying Passengers for Hire	
Cleaning Vehicles .....	30
Materials on Passenger Vehicles .....	31
 <b>Chapter III.—CIVIL AIR REGULATIONS</b>	
 <b>Part 49.—TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES</b>	
Acceptable Articles on Cargo and Passenger Aircraft .....	35
Applicability .....	33
Definitions .....	33-34
Exempted Articles .....	36

	Page
Packing, Marking, and Labeling-----	34
Special Authority-----	37
 <b>Chapter IV.—Part 146.—U. S. COAST GUARD REGULATIONS</b>	
Exemptions-----	39
Marking and Labeling-----	39
 <b>Subpart E.—Detailed Regulations Governing Poisonous Articles</b>	
Definitions-----	40
Exemptions-----	41
Packing and Shielding-----	41-43
 <b>Chapter V.—U. S. POSTAL REGULATIONS</b>	
Conditions Under Which Articles will be Accepted-----	45
 <b>Chapter VI.—AUXILIARY INFORMATION FOR SHIPPERS</b>	
Accident Leakage, Spillage, or Sifting-----	48
Exclusive Use of Aircraft for Transporting Radioactive Material-----	48
Limitation on Number of Units-----	47
Notification to Consignee of Shipments of Radioactive Materials-----	48
Permits-----	48
Regulations Pertaining to Carriers-----	47
Violations of Regulations-----	48

## *Chapter I*

### INTRODUCTION AND GENERAL INFORMATION

THIS HANDBOOK is designed to be of assistance in locating and understanding Federal regulations applying to the shipment of radioactive materials. Portions of pertinent regulations promulgated by the Interstate Commerce Commission, Civil Aeronautics Board, U. S. Coast Guard, and Post Office authorities are reproduced in the Handbook together with comments believed to be helpful in determining the proper application of the regulations. An explanation of technical terms not defined in the regulations is also given. The last chapter of the Handbook contains auxiliary information to shippers and includes a number of miscellaneous items that should be helpful in determining the manner of shipment and shipping responsibilities.

The following limitations should be noted:

1. It is not within the province of the Atomic Energy Commission to make official interpretations of regulations established by other agencies. In this Handbook interpretations known to be highly controversial are not given.
2. Both the selection of excerpts and the comments included in this Handbook are unofficial as far as the regulating agencies are concerned.
3. Comments given herein, while based on the best information available to the authors of this Handbook, are not based on court decisions nor on official interpretations by the regulating agencies.
4. The regulations excerpted herein are subject to change with due notice in the *Federal Register* or, in the case of U. S. postal regulations, in the *Postal Bulletin*.

Persons responsible for the conformance of shipments of radioactive materials to Federal transportation regulations should have access to and be familiar with the complete regulations applicable to such shipments.

The Handbook does not provide any guide to AEC security policies and regulations applicable to the transportation of classified materials. These are discussed in Chapter 2402, AEC Manual, "Security of Matter in Transit." Further information or other aid on the shipping problems may be obtained from the appropriate Manager of Operations, or, through his office, from the Director, Division of Construction and Supply.

Detailed information on many of the basic problems involved in the transportation of radioactive materials is contained in a preliminary

report, "Physical, Biological, and Administrative Problems Associated with the Transportation of Radioactive Substances," by Robley D. Evans, Chairman of the Subcommittee on Shipment of Radioactive Substances, Committee on Nuclear Science, Division of Physical Sciences, National Research Council. This report, issued as Publication 205, is available for \$1 at the Publications Office of the National Research Council, Washington 25, D. C.\*

Transportation of radioactive materials in interstate commerce by land or water is subject to regulations of the Interstate Commerce Commission. The ICC does not issue separately its regulations applying specifically to shipments of radioactive materials (or to any other commodity or group of commodities). The complete regulations covering the packaging, labeling, and transportation of dangerous articles are published as Title 49, Parts 71 to 78 of the Code of Federal Regulations. Between revisions, annual pocket supplements are issued. Amendments subsequent to the period covered by the most recent revision or annual supplement may be obtained from the daily issues of the *Federal Register*. All of these are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

The ICC regulations are published also by the Bureau of Explosives of the Association of American Railroads, H. A. Campbell, Agent, 30 Vesey Street, New York 7, N. Y., as "Tariff No. 9, Publishing Interstate Commerce Commission Regulations for Transportation of Explosives and Other Dangerous Articles . . .," and by the Tariff Bureau of the American Trucking Associations, Inc., F. G. Freund, Agent, 1424 16th St., N. W., Washington 6, D. C., as "Motor Carriers' Explosives and Dangerous Articles Tariff No. 8." Prices of \$3.50 and \$3, respectively, include all supplements issued.

Transportation of radioactive materials in aircraft is regulated by the Civil Aeronautics Board. Applicable regulations are published in Title 14, Part 49, of the Code of Federal Regulations. Part 49 of the Civil Air Regulations, "Transportation of Explosives and Other Dangerous Articles" is also published separately and is for sale by the Superintendent of Documents, U. S. Government Printing Office, at 10 cents. Page 9 of this publication provides instructions for obtaining amendments issued since the last printing.

In addition to the minimum restrictions on transportation by air prescribed by the Civil Aeronautics Board, various individual airlines further restrict the conditions under which they will accept radioactive and other materials for transportation. A compilation of these restrictions is issued as "Official Air Transport Restricted Articles Tariff," by Emery F. Johnson, Agent, National Airport,

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\*Revised May 3, 1955.

Washington 1, D. C. The annual subscription price, including supplements, is \$2.50.

Transportation of radioactive materials by water is subject to regulations prescribed by the Commandant of the U. S. Coast Guard. Current regulations applicable to radioactive materials appear in Title 46, Part 146 of the Code of Federal Regulations, as amended, see *Federal Register*, July 17, 1952, page 6460 ff., and December 31, 1952. The U. S. Coast Guard regulations covering transportation, storage or stowage of dangerous articles on ships are also published by the Bureau of Explosives, H. A. Campbell, Agent, 30 Vesey Street, New York 7, N. Y., as "Water Carrier Tariff No. 6." All regulations applicable to radioactive materials published to December 1953, appear in supplement 16 to this tariff.

Regulations governing the transportation of radioactive materials in the U. S. mails are given in the *U. S. Postal Guide*. In the 1951 edition, they appear on page 51 of Part I.

Persons responsible for export shipments of radioactive materials should determine what regulations may apply to such shipments in countries to which they are made. See paragraphs 73.8 and 73.9 of the ICC regulations, excerpted in Chapter II, for statements relative to Canadian and other foreign shipments.

The regulations issued by the Civil Aeronautics Board and by the U. S. Coast Guard embody the packaging and labeling requirements of the Interstate Commerce Commission. U. S. Postal Regulations permit transportation by mail of only those radioactive materials which under ICC regulations are exempt from specification packaging and labeling. (Such packages must, however, be labeled as prescribed by the Postal Regulations when submitted for transportation in U. S. mail.) For these reasons, definitions, regulations, etc., common to the ICC and another regulatory agency are discussed only where they first appear in the ICC regulations.

## *Chapter II*

### **ICC REGULATIONS GOVERNING THE TRANSPORTATION OF RADIOACTIVE MATERIALS**

The transportation of radioactive materials moving in interstate commerce by rail, water or by public highway (except in U. S. mail) is regulated by the Interstate Commerce Commission. Some states extend the ICC regulations to intrastate transportation. In addition, local authorities may impose additional limitations upon the transportation of radioactive materials, as in the case of their movement through tunnels or within port areas.

The Interstate Commerce Regulations covering the Transportation of Explosives and Other Dangerous Articles include eight parts of Title 49 of the Code of Federal Regulations, as follows:

Part 71.—General Information and Regulations.

Part 72.—Commodity List of Explosives and Other Dangerous Articles . . .

Part 73.—Regulations Applying to Shippers.

Part 74.—Regulations Applying Particularly to Carriers by Rail Freight.

Part 75.—Regulations Applying to Carriers by Rail Express . . .

Part 76.—Regulations Applying to Rail Carriers in Baggage Service . . .

Part 77.—Regulations Applying to Shipments Made by Way of Common, Contract or Private Carriers by Public Highway.

Part 78.—Shipping Container Specifications.

This chapter is concerned primarily with regulations directly applicable to the shipper of radioactive materials. Regulations of particular interest, including all of the regulations in Part 73 applying specifically to radioactive materials, are excerpted below. Some excerpts are followed by comments intended to facilitate the interpretation or the application of the regulations to which the comments refer. The inclusion of these comments gives them no regulatory status except as they are related to AEC operations. Limitations on the nature of these comments are set forth in greater detail on page 1, Chapter I.

In addition to a limited number of excerpts from Parts 71-72 and Parts 74-77, comments on some of the provisions of these parts are given in Chapter VI. Specifications for shipping containers, given in Part 78, prescribed by these regulations, are not excerpted.

In this Handbook, excerpts from the regulations of the Interstate Commerce Commission and of other Federal agencies are distinguished from comments on these regulations by subparagraphs and indentation.\* Omissions from a paragraph are represented by "...", and omission of one or more paragraphs of a section is represented by "\*\*\*\*\*". Omission of entire sections is not, in general, indicated.

## Part 71.—General Information and Regulations

### 71.1. *Plan of the regulations in Parts 71-78:*

(a) Regulations in Parts 71-78 cover preparation of explosives and other dangerous articles for transportation by common carriers by rail freight, rail express, rail baggage, highway or water, construction of containers, packing, weight, marking, labeling when required, billing and shipper's certificate of compliance with these regulations; also cars, loading, storage, billing, placarding, and movement thereof by carriers by rail.

(b) Regulations for equipment and operation of motor vehicles on the highways are published in separate issue of the Commission.

### 71.2. *Act of Congress:*

(a) Section 834, Title 18 of the United States Code, approved June 25, 1948 (Pub. Law 772, 80th Cong.), provides that whoever knowingly delivers to any common carrier engaged in interstate or foreign commerce by land or water, or carries upon any car or vehicle operated by any common carrier engaged in interstate or foreign commerce by land, any explosive or other dangerous article specified in section 832, under any false or deceptive marking, description, invoice, shipping order or declaration, or without informing the agent of such carrier, in writing, of the true character thereof, or does not plainly mark on the outside of every package containing explosives or other dangerous articles the contents thereof, shall be fined or imprisoned, or both, as provided in this act.

### 71.3. *Changes in the regulations, shippers by rail, highway, and water, and carriers by rail and highway:*

(a) Section 835 of the act of June 25, 1948, authorizes the Commission to formulate regulations for the safe transportation of explosives and other dangerous articles and either upon its own motion, or upon application by any interested party, to make changes or modifications in such regulations, made desirable by new information or altered conditions. It further provides that in the execution of sections 831-835 of the Act the Commission may utilize the services of the Bureau for the Safe Transportation of Explosives

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\*Revised May 3, 1955.

and other Dangerous Articles (hereinafter called Bureau of Explosives). The Bureau of Explosives will make inspections and conduct investigations and will confer with manufacturers and shippers with a view to determining what regulations will within reasonable limits afford the highest degree of safety in preparing and packing explosives and other dangerous articles for transportation by carriers by rail, highway, or water. The Commission will give due weight to the expert opinions thus obtained. Reports of these investigations will be made to the Commission with recommendations.

(b) Specifications for shipping containers, methods of packing for shipment, and other regulations will be considered and prescribed from time to time by orders effective as conditions may appear to warrant.

#### *71.6. Approved changes; notice:*

(a) The act of June 25, 1948, requires that notice of 90 days after formulation and publication should be given of the effective date of new or modified regulations, unless a shorter time is authorized by the Commission. The authority to establish amended regulations upon less than 90 days' notice will be exercised only in instances where special and peculiar circumstances or conditions fully justify it.

#### *71.7. Public hearings:*

(a) Public hearings concerning regulations contained in Parts 71-78 will be held by the Commission at sufficiently frequent intervals. At these hearings evidence may be introduced in favor of proposed changes or additions and protest against the adoption thereof will also be heard. Final action also may be taken by the Commission without hearing, following 20 days' notice by the Commission of proposed changes or additions, or without such notice, as conditions appear to warrant.

#### *71.11. Transportation by carriers by water:*

(a) When the transportation of a shipment involves movement by carrier by water, the applicable provisions of Parts 71-78 must be observed by the shipper.

#### *71.12. Export shipments by domestic carriers by rail and motor vehicles:*

(a) Explosives and other dangerous articles authorized to be exported from the United States when packed, marked, labeled, and described, in accordance with rules and regulations in force at destination ports, must not be offered to any common carrier by rail or motor vehicle for domestic transportation unless in full accordance with the regulations in Parts 71-78.

(b) Except for the requirements of 77.817 and 77.823, the provisions of Parts 71-78 do not apply to such transportation by motor vehicle or water as may be necessary to effect transfer of export shipments from place of shipment to other places within the same port area or delivery to a water carrier within the same port area (including contiguous harbors). Further transportation of such export shipments by connecting water carrier shall be subject to the regulations prescribed by the Commandant of the Coast Guard.

**Part 72.—Commodity List of Explosives and Other Dangerous Articles Containing the Shipping Name or Description of All Articles Subject to Parts 71-78**

**72.1. *Proper shipping name:***

(a) The proper shipping name which must be used and shown on outside shipping containers appears [in the commodity list, 72.5] in roman type (not italics) . . . .

The words between brackets above do not appear in the ICC regulations.

**72.3. *Labels required and prohibited articles:***

(a) Section 72.5 of this part also shows the kind of label when required on shipments of explosives and other dangerous articles and the articles which are prohibited for transportation.

Section 72.5, referred to in 72.3, is a list of explosives and other dangerous articles to which the regulations of Parts 71-78 apply. Items are listed in alphabetical order and for each item there is given the proper shipping name, the class of hazard, cross references to sections specifying exemptions and packing, color of label required if not exempt, and maximum quantity in one outside container for shipment by rail express. All radioactive materials are classed as poison, class D, and are properly shipped as "radioactive materials." Blue or red label is required, as specified in section 73.414.

**Part 73.—Regulations Applying to Shippers**

**73.1. *Purpose of the regulations in Parts 71-78:***

(a) To promote the uniform enforcement of law and to minimize the dangers to life and property incident to the transportation of explosives and other dangerous articles by common carriers engaged in interstate or foreign commerce, the regulations in Parts 71-78 are prescribed to define these articles for transportation purposes, to state the precautions that must be observed by the shipper in preparing them for shipment by rail freight, rail express, rail baggage, highway, or by carrier by water. It is the duty of each such shipper to make the prescribed regulations effective and to thoroughly instruct employees in relation thereto.

Except as otherwise specified, each of the regulations given in Part 73 is applicable to articles prepared for shipment by any of the modes of transportation named in paragraph 73.1 (a).

(b) Explosives and other dangerous articles may be offered to carriers for transportation provided the articles are in proper condition for transportation, are as defined, and are packed, marked, labeled, described, certified, and otherwise as provided for in Parts 71-78 for acceptable articles for transportation by rail freight, rail express, rail baggage, highway, or water. Articles must be loaded and stayed according to regulations in Parts 71-78 applying to carriers by rail. Methods of manufacture, packing, and storage, insofar as they affect safety in transportation, must be open to inspection by a duly authorized representative of the initial carrier or of the Bureau of Explosives. Shipments that do not comply with the regulations in Parts 71-78 must not be offered for transportation.

### 73.2. *Classification; dangerous articles:*

(a) Dangerous articles other than explosives having more than one hazardous characteristic, as defined by the regulations in Parts 71-78 must be classified according to the greatest hazard present, except those articles which are also poisons, class A, or class D, which must be classified according to both dangerous characteristics as defined herein.

This applies to all radioactive materials (i. e., poisons, class D) which have also another "hazardous" characteristic, unless exempt from specification packing, marking, and labeling under the provisions of 73.392. An example is radioactive metallic sodium which is classed also as a flammable solid. If the radioactivity exceeds that specified in 73.392 (a) (2), it is subject both to the regulations applying to radioactive materials and to flammable solids. (No quantity of metallic sodium is exempt from specification packing, marking, and labeling as a flammable solid. See 72.5 and 73.206 for details.) 73.402 (a) (2) provides that such a package shall carry both the appropriate radioactive materials warning label specified in 73.414 and the yellow warning label for a flammable solid specified in 73.406. A similar situation exists in the case of radioactive sodium alloy.

Other examples of materials to which 73.2 may be applicable are powdered thorium metal (see 73.226) and tritium gas. While no quantity of powdered thorium metal is exempt from specification packing, marking and labeling as a flammable solid, because of its low activity, a sizable quantity (the magnitude of which depends upon the interpretation of 73.392 (a) (2)) is exempt from specification labeling as a radioactive material.

### 73.7. *United States Government shipments:*

(a) Shipments of explosives or other dangerous articles offered by or consigned to the Departments of the Army, Navy, and Air

Force of the United States Government, must be packed, including limitations of weight, in accordance with the regulations in this part or in containers of equal or greater strength and efficiency as required by their regulations.

(b) Shipments of radioactive materials, made by the Atomic Energy Commission, or under its direction or supervision, which are escorted by personnel specially designated by the Atomic Energy Commission, are exempt from the regulations in Parts 71-78.

While shipments of radioactive materials made under the provisions of paragraph 73.7(b) are legally exempt from all of the regulations in Parts 71-78, no such shipment should be made under conditions which provide less over-all protection to the carrier, to the public, or to the consignee than would be provided by the ICC regulations if the shipment were not exempt. In particular, shipment under escort should not be permitted to cover careless packaging and handling. AEC Bulletin GM-SFP-3 (Serial No. 133), paragraph 4 f., specifies the ICC regulations as the standard of safety in the transportation of radioactive materials, without exception; and section 3 of this Bulletin makes Managers of Operations responsible for the interpretation and application of this and other standards of safety specified therein.

Shipment under the provisions of paragraph 73.7 (b) of the ICC regulations are subject to the prior approval of the Operations Manager or of his authorized representative. It is the responsibility of the person approving such shipment to determine whether the safety involved depends to a considerable extent upon the ability of an escort to effect appropriate precautions under hazardous conditions which may arise in transit. If it does, he shall designate as an escort a person whom he considers to be adequately trained, equipped and instructed to meet such conditions as might arise in connection with the shipment he is to escort. This does not preclude designation as an escort, under the provisions of paragraph 73.7 (b), a person who may accompany the shipment for reasons other than safety, e. g., as a security guard or as the driver of a vehicle, provided that in the judgment of the Operations Manager or of his authorized representative such person meets the above condition.

Shipments of radioactive materials by AEC contractors may be made under the provisions of paragraph 73.7 (b) provided they are escorted by personnel specifically approved by the Atomic Energy Commission for the shipments involved. Such approval shall be obtained through normal contractual channels from the Manager of Operations or his authorized representative.

Specific approval by the Bureau of Explosives or by the Interstate Commerce Commission of the shipment of radioactive materials under the provision of 73.7 (b) is not required.

### 73.8. *Canadian shipments:*

(a) Explosives and other dangerous articles, as defined in Parts 71-78 which are packed, marked, labeled, and loaded, in conformity with the regulations of the Board of Transport Commissioners for Canada, may be transported from point of entry in the United States to their destination in the United States or through the United States en route to a point in Canada. . . .

(b) Specification containers made and maintained in full compliance with corresponding specifications prescribed by the Board of Transport Commissioners for Canada in its Regulations for the Transportation of Explosives and Other Dangerous Articles by Freight, and Specifications for Shipping Containers, and marked in accordance therewith, CRC etc., may be used for shipment of explosives and other dangerous articles offered for transportation by carriers by rail freight, rail express, highway, or water.

Canadian regulations for shipment of radioactive materials by rail are essentially identical with those of the U. S. Interstate Commerce Commission, including arrangement and numbering. (Shipment of explosives and other dangerous articles by motor truck in Canada is not regulated at the time of compilation of this Handbook, 1953. Special permits or other special arrangements are approved by the Board of Transport Commissioners. Requests involving containers for which permits have been issued in the United States by the Bureau of Explosives will be facilitated by including with other pertinent information the Bureau of Explosives permit numbers of the containers to be used. (See discussion on permits in Chapter VI.)

Shipments of radioactive materials in Canada, made by Atomic Energy of Canada Limited, or under its direction or supervision, which are escorted by personnel specially designated by Atomic Energy of Canada Limited, are exempt from the regulations of the Board of Transport Commissioners.

### 73.9. *Import and export shipments:*

(a) Import shipments of explosives and other dangerous articles offered in the United States in original packages for transportation by carriers by rail freight, rail express, motor vehicle, or water must comply with all requirements of the regulations in Parts 71-78. The importer must furnish with the order to the foreign shipper, and also to the forwarding agent at the port of entry, full and complete information as to the packing, marking, labeling, and other requirements, as prescribed in Parts 71-78. The forwarding agent must file with the initial carrier in the United States a properly certified shipping order or other shipping paper as prescribed in this part. Except for the requirements of 77.817 and 77.823, the provisions of Parts 71-78 do not apply to such transportation by

motor vehicle or water as may be necessary to effect transfer of import shipments from place of discharge to other places within the same port area or delivery to a water carrier within the same port area (including contiguous harbors). Further transportation of such import shipments by connecting water carrier shall be subject to the regulations prescribed by the Commandant of the Coast Guard.

(b) Shipments of explosives and other dangerous articles offered for transportation by common carrier by water from the United States, its insular possessions, or dependencies, destined to such insular possessions or territory, dependencies, or to a foreign country, must be packed, marked, labeled and described in accordance with the rules and regulations in force at destination ports or as prescribed in Parts 71-78.

*73.11. Violations and accidents to be reported:*

(a) Consignees must report promptly to the Bureau of Explosives all instances of improper staying and broken, leaking, or defective containers of explosives or other dangerous articles in shipments received by them.

(b) The Bureau of Explosives, upon receipt of reports from consignees, should promptly report to the shipper full particulars covering all such cases.

**Subpart A.—Preparation of articles for transportation by carriers by rail freight, rail express, highway, or water**

*73.27. Rail express limitations:*

\* \* \* \* \*

(c) When several dangerous articles are placed in one outside package without violating the regulations, the combined quantity of any one group must not exceed the lowest limit prescribed for any one of the articles of that group that is included.

*73.29. Empty containers:*

(a) Empty cylinders, barrels, kegs, drums, or other containers except carboys (see paragraph (c) of this section) previously used for the shipment of any explosive or other dangerous article, as defined in this part, if authorized for reuse must have all openings including removable heads, filling and vent holes, tightly closed before being offered for transportation. Small quantities of the material with which containers were loaded may remain in "empty" containers and when the vapors remaining therein are unstable, it is permissible to add sufficient inert gas to render the vapors stable.

\* \* \* \* \*

(e) All containers and accessories which have been used for shipments of radioactive materials when shipped as empty must be

sufficiently free of radioactive contamination so as to conform to the conditions of paragraph (a)(1), (2), and (3) of 73.392 of this part.

(f) Containers shipped as "empty" must have the old labels prescribed by this part removed, obliterated, destroyed, or completely covered by a square white label as described in 73.413 of this part, measuring not less than six inches on each side, and bearing thereon the word "EMPTY" in letters not less than one-inch high. This does not apply to carload or truckload shipments to be unloaded by consignee.

Since the use of warning labels on used containers shipped as "Empty" is prohibited, it is desirable that in cases in which the consignee may be inconvenienced by unsuspected radioactive content of such containers he should be directly informed of the shipment. Such shipments may also be entered on bills of lading or other shipping papers as "Empty containers which have contained radioactive materials." However, such description does not provide positive assurance that the information will appear on papers reaching the consignee, since in transcribing the description from one set of papers to another the carrier may shorten the description to the minimum required for tariff classification, "Empty Containers."

**73.30 Loading and placarding of cars by shippers and unloading of cars by consignees:**

(a) When shipments of explosives or other dangerous articles are loaded into cars by shippers, or unloaded from cars by the consignee or his duly authorized agent, the applicable provisions of Part 74 must be complied with. See 74.538 for loading and storage chart.

**Subpart D.—Flammable solids and oxidizing materials; . . .**

**73.226. Thorium metal, powdered:**

(a) Thorium metal, powdered, must be packed in specification containers as follows:

1. Spec. 15A or 15B. Wooden boxes with inside metal containers, tightly and securely closed by push-in covers held in place by soldering at least at four points, or in screw-cap type metal cans. Inside containers must not exceed 10 pounds net each. Gross weight of outside packages must not exceed 75 pounds each.

**Subpart G.—Poisonous articles; definition and preparation**

**73.391. Radioactive materials class D Poison, Radioactive materials label; definition:**

(a) For the purpose of Parts 71-78 radioactive material is any material or combination of materials that spontaneously emits

ionizing radiation. For the purpose of Parts 71-78, radioactive materials are divided into three groups according to the type of rays emitted at any time during transportation, as follows:

1. *Group I.*—Radioactive materials that emit gamma rays only or both gamma and electrically charged corpuscular rays.
2. *Group II.*—Radioactive materials that emit neutrons and either or both the types of radiation characteristic of Group I materials.
3. *Group III.*—Radioactive materials that emit electrically charged corpuscular rays only; i. e., alpha or beta, etc., or any other that is so shielded that the gamma radiation at the surface of the package does not exceed 10 milliroentgens for 24 hours at any time during transportation.

Since all materials are radioactive to some degree, it must be presumed that the above definition of a radioactive material is intended to apply only to materials having a history which suggests that they have a higher degree of radioactivity than is normal to materials in common usage. For example, materials which may have been subjected to a considerable quantity of activating radiation, materials which may have been contaminated with radioactive materials, or materials from mines containing radioactive ores must be considered to come under this definition unless it is known that their radioactivity is within the range of that of materials not normally considered to be radioactive.

For purposes of ICC regulations, packages of radioactive materials are classified as Group I, Group II, or Group III to facilitate the statement of regulations covering labeling and handling. Packages classed as Group I or Group II require special precautions in transit and in storage to protect personnel and photographic film from radiations emitted from the packages. The stipulation "at any time during transportation" in describing a Group III package is made necessary by the fact that the gamma radiation from some packages will increase during transit due to the formation of gamma-emitting daughter products of the radioisotope being shipped.

(b) Not more than 2,000 millicuries of radium, polonium or other members of the radium family of elements, and not more than 2,700 millicuries (disintegration rate of 100,000 million ( $10^{11}$ ) atoms per second) of any other radioactive substance may be packed in one outside container for shipment by rail freight, rail express, or highway, except by special arrangements and under conditions approved by the Bureau of Explosives or except as specifically provided in subparagraph (c) of this section.

NOTE 1.—For purposes of Parts 71-78 of this chapter, one millicurie is that amount of any radioactive material which disintegrates at the rate of 37 million atoms per second.

(c) Not more than 300 curies of solid cesium 137, cobalt 60 or iridium 192, may be packed in one outside container for shipment by rail freight, rail express, or highway, except by special arrangements and under conditions approved by the Bureau of Explosives.\*

Within the AEC, activities of shipments of all radioactive materials generally are measured in curies or in sub-multiples of curies. One curie is equivalent to 1,000 millicuries or to 1,000,000 microcuries. From Note 1 above, "that amount of any other radioactive substance which disintegrates at the rate of 100,000 million atoms per second" is 2.7 curies.

Paragraph 73.391 (b)\* is generally interpreted as permitting the shipment of 2 curies (2 grams) of Ra<sup>226</sup> in a single package, regardless of the fact that, as ordinarily shipped, the package would contain approximately two curies each of a number of radioactive decay products. That this was the intent of the National Research Council sub-committee formulating the original draft of these regulations, is indicated by the following statement from page 39 of NRC Publication 205: "The maximum quantity of radium whose shipment is permitted in a single container, as in a neutron source, is 2000 mc. or 2 gm. Ra." Field comment indicates, however, that some AEC installations interpret the two curies as applying to all of the radioactive material believed to be in the package. The latter interpretation receives some support from 73.27 (b). The interpretation of this paragraph as applied to other radioactive substances, e. g., uranium, thorium, strontium 90, zirconium 95, is also controversial.

#### 73.392. *Exemptions for radioactive materials:*

(a) Radioactive materials are exempt from prescribed packaging, marking and labeling requirements provided they fulfill all of the following conditions:

1) The package must be such that there can be no leakage of radioactive material under conditions normally incident to transportation.

2) The package must contain not more than 0.1 millicuries of radium, or polonium, or that amount of strontium 89, strontium 90, or barium 140 which disintegrates at a rate of more than 5 million atoms per second; or that amount of any other radioactive substance which disintegrates at a rate of more than 50 million atoms per second.

That amount of material which disintegrates at the rate of 5 million atoms per second is 0.135 millicuries; and that which disintegrates at the rate of 50 million atoms per second is 1.35 millicuries.

3) The package must be such that no significant alpha, beta, or neutron radiation is emitted from the exterior of the package and

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\*Revised May 3, 1955.

the gamma radiation at any surface of the package must be less than 10 milliroentgens for 24 hours.

(b) Manufactured articles other than liquids, such as instrument or clock dials or electronic tubes and apparatus, of which radioactive materials are a component part, and luminous compounds, when securely packed in strong outside containers are exempt from specification packaging, marking, and labeling requirements provided the gamma radiation at any surface of the package is less than 10 milliroentgens in 24 hours.

1) Switchboard or similar apparatus containing electronic tubes, of which radioactive materials are a component part, are exempt from specification packaging, marking, and labeling requirements when shipped in carload or truckload lots or when transported by private motor carrier provided the gamma radiation at any readily accessible surface of the units, when prepared for shipment, does not exceed 50 milliroentgens in 24 hours.\*

(c) Radioactive materials such as ores, residues, etc., of low activity packed in strong tight containers are exempt from specifications packaging and labeling requirements for shipment in carload lots by rail freight only provided the gamma radiation or equivalent will not exceed 10 milliroentgens per hour at a distance of 12 feet from any surface of the car and that the gamma radiation or equivalent will not exceed 10 milliroentgens per hour at a distance of 5 feet from either end surface of the car. There must be no loose radioactive material in the car, and the shipment must be braced so as to prevent leakage or shift of lading under conditions normally incident to transportation. The car must be placarded by the shipper as provided in 74.541 (b) and 74.553. Shipments must be loaded by consignor, and unloaded by consignee.

Paragraph 73.392 (c) provided exemption from specification packaging, marking and labeling for shipments of packaged low activity materials by rail freight, in carload lots only, subject to the conditions given therein. Such exemption is provided independently of the general conditions for exemption from specification packaging, marking and labeling given in paragraph 73.392 (a). However, such materials are not exempt from specification packaging, labeling and marking when shipped by motor truck or by railway express unless they meet the requirements of 73.392 (a). *See, for example, 77.815 (a), (b), and (c).*

The term "low activity material" is not defined by the ICC. The wording of 73.392 (c) and of 74.532 (j) (1) implies that any gamma emitting material, a full carload of which does not produce radiation in excess of 10 mr./hr. at a distance of 12 feet from any surface of the car may be considered low activity material for this purpose.

\*Revised May 8, 1955.

Limitation of the radiation from either end of the car to 10 mr./hr. at 5 feet may be achieved either by spacing or by the use of shielding.

The term "no loose material" is not defined by the ICC. The usage here and in paragraph 74.532 (j) implies that "loose material" means amounts of material which may be introduced as a result of spillage, either within the car or onto the containers or equipment which are brought into the car. The level of gamma radiation which may exist in the car after unloading is specified in section 73.395.

*73.393. Packing and shielding:*

(a) Radioactive materials that present special hazards due to their tendency to remain fixed in the human body for long periods of time (i. e., radium, plutonium, and radioactive strontium, etc.) must, in addition to the packaging hereinafter prescribed, be packed in inside metal containers specification 2R, or other container approved by the Bureau of Explosives.

Specifications for 2R containers are given in Section 78.34 of the ICC Regulations (not excerpted in this Handbook). The requirement that packages containing radium, plutonium, etc., be packed in inside containers of this specification is not considered to apply to cases in which these radioisotopes occur in low activity materials as discussed in 73.392 (c) or as impurities in other radioactive materials.

(b) All radioactive materials must be so packed and shielded that the degree of fogging of undeveloped film under conditions normally incident to transportation (24 hours at 15 feet from the package) will not exceed that produced by 11.5 milliroentgens of penetrating gamma rays of radium filtered by  $\frac{1}{2}$  inch of lead.

The quantity of gamma radiation referred to, 11.5 milliroentgens, is that measured after filtration by the lead. Photographic emulsions are more sensitive to gamma radiations of quantum energies less than about 0.15 Mev than to harder or more penetrating gamma radiation of higher quantum energies. Filtration of radium gamma radiation by this thickness of lead removes practically all of the quanta with energies as low as 0.15 Mev and provides an arbitrary standard of photographic effectiveness with which other gamma radiation may be compared.

For cases in which the gamma emission from the radioactive materials within the package contains a strong component of quantum energy higher than about 0.2 or 0.3 Mev, and a substantial amount of lead shielding is used in bringing the radiation from the package down to prescribed limits, the gamma radiation emitted from the package may be considered to have the same photographic effectiveness per milliroentgen of exposure as gamma radiation from radium filtered by  $\frac{1}{2}$  inch of lead. Ordinarily, for Group I packages, this is the case.

The following table, adapted from Table IX, p. 48, NRC Publication 205 (cited in Chapter I of this Handbook), gives the relative sensitivity of photographic emulsions to gamma radiations of different quantum energies below 0.15 Mev as compared to sensitivity to radium radiation filtered as specified above:

Quantum energy-----	0.14	0.12	0.09	0.075	0.06	0.045	0.03
Relative sensitivity-----	1.2	2.3	4.9	8.6	14	21	24

As an example of the application of these values to paragraph 73.393(b), if a package emits gamma radiation of which the effective quantum energy is 0.09 Mev, the maximum gamma radiation permitted at 15 feet from the package is  $11.5/4.9$  milliroentgens per 24 hours. For a more complete discussion, the reader is referred to NRC Publication 205, pp. 15-24 and 48-49.

(c) The design and preparation of the package must be such that there will be no significant radioactive surface contamination of any part of the container.

(d) The smallest dimension of any outside shipping container for radioactive materials must be not less than 4 inches.

(e) All outside shipping containers must be of such design that the gamma radiation will not exceed 200 milliroentgens per hour or equivalent at any point of readily accessible surface. Containers must be equipped with handles and protective devices when necessary in order to satisfy this requirement.

(f) The outside shipping container for any radioactive material, unless specifically exempt by 73.392 or unless approved by the Bureau of Explosives, shall be as follows: (1) Spec. 15A or 15B (78.168 or 78.169 of this chapter). Wooden boxes. Authorized for not more than 2,700 millicuries; (2) Spec. 12B (78.205 of this chapter). Fibreboard boxes. Authorized for not more than 2,700 millicuries; (3) Spec. 21A or 21B (78.222 or 78.223 of this chapter). Fibre drums. Authorized for not more than 2,700 millicuries; (4) Spec. 6A, 6B, or 6C. 17C or 17H (single-trip) (78.97, 78.98, 78.99, 78.115 or 78.118 of this chapter). Metal barrels or drums. Authorized for not more than 2,700 millicuries; (5) Spec. 55 (78.250 of this chapter). Metal-encased, lead-shielded containers. Authorized for not more than 300 curies (see 73.391). Containers must be equipped with a seal.\*

Specifications for these containers are given in Part 78 of ICC regulations. These specifications are not excerpted in this Handbook.\*

(g) Radioactive materials Group I, liquid, solid, or gaseous, must be packed in suitable inside containers completely surrounded by a shield of lead or other suitable material of such thickness that at any time during transportation the gamma radiation at one meter

\*Revised May 3, 1955.

(39.3 inches) from any point on the radioactive source will not exceed 10 milliroentgens per hour. The shield must be so designed that it will not open or break under conditions incident to transportation. The minimum shielding must be sufficient to prevent the escape of any primary corpuscular radiation to the exterior of the outside shipping container.

“. . . at one meter from any point on the radioactive source . . .” is interpreted to mean “at one meter from the nearest point on the source.”

(h) Radioactive materials Group II, liquid, solid, or gaseous, must be packed in suitable inside containers, completely shielded so that at any time during transportation the radiation measured at right angles to any point on the long axis of the shipping container will not exceed the limits specified in subparagraphs (1) to (4) of this paragraph. The shielding must be designed so as to maintain its efficiency under conditions normally incident to transportation and must provide personnel protection against fast or slow neutrons and all other ionizing radiation originating in the radioactive materials or any part of the aggregate constituting the complete package.

(1) Gamma radiation of 10 mrhm.

(2) Electrically charged corpuscular radiation which is the physical equivalent (see note 1 of this paragraph) of 10 mrhm. of gamma radiation.

(3) Neutron radiation which is the physical equivalent (see note 1 of this paragraph) of 2 mrhm. of gamma radiation.

(4) If more than one of the types of radiation named in subparagraphs (1), (2), and/or (3) of this paragraph is present the radiation of each type must be reduced by shielding so that the total does not exceed the equivalent of subparagraphs (1), (2), or (3) of this paragraph.

NOTE 1.—For purposes of Parts 71-78 the “physical equivalent” of a roentgen is that amount of radiation that would be absorbed in tissue to the extent of 100 ergs per gram (mrhm. is an abbreviation for milliroentgens per hour at 1 meter (39.3 inches)).\*

(i) Liquid radioactive materials Groups I, II or III must, in addition, be packed in tight glass, earthenware, or other suitable inside containers. The inside containers must be surrounded on all sides and within the shield by an absorbent material sufficient to absorb the entire liquid contents and of such nature that its efficiency will not be impaired by chemical reaction with the contents. If the container is packed in a metal container specification 2R or other container approved by the Bureau of Explosives, the absorbent cushioning is not required.

\*Revised May 3, 1955.

(j) Radioactive materials Group III, liquid, solid or gaseous, must be packed in suitable inside containers completely wrapped and/or shielded with such material as will prevent the escape of primary corpuscular radiation to the exterior of the shipping container, and secondary radiation at the surface of the container must not exceed 10 milliroentgens per 24 hours, at any time during transportation.

(k) In determining compliance with requirements of paragraphs (e), (g), (h), and (j) of this section measurements of radiation must be made with a Landsverk-Wollan Electrometer Model L-100 or equally efficient standardized meter.

Acceptable instruments for measuring the gamma radiation from packages include the gamma survey meters listed in the SIC series of the AEC Instruments Catalog. Acceptable instruments for the measurement of fast neutron emission include the fast neutron instruments listed in the SIC and SPC Series of the AEC Instruments Catalog.

*73.394. Radioactive materials labels:*

(a) Each outside container of radioactive material Group I or II, unless exempt by 73.392 of this part, must be labeled with a properly executed label as described in 73.414 (a) of this part.

A properly executed label for Group I or Group II requires the name of the principal radioisotope or radioelement, the activity of the contents (measured in curies or in disintegrations per second), the number of units of radiation from the package, and the name of the shipper. If the nature of the radioactive content cannot be appropriately designated by entering a single radioisotope or radioelement, it may be described as "Chemical NOS" (i. e., chemical, not otherwise specified). See comments on paragraph 73.392 (a) (2) for relations between activity and weight of radium, uranium, and thorium.

The number of radiation units is a measure of the gamma radiation from the package as defined in the Note of 73.414 (a), not of the quantity of radioactive material in the package. For cases in which the quantum energy of the radiation is less than 0.15 Mev, see the discussion following paragraph 73.393 (b) above. The actual number of radiation units should be entered on the label. Use of such statements as "less than 10" is unacceptable since this may lead to unnecessary restrictions if several packages occur in the same car, truck, or terminal. (See 75.655 (j) (3) and 77.841 (d) (2) for regulations limiting transportation by one car or vehicle and storage in one place to 40 units.)

(b) Each outside container of radioactive material Group III must unless exempt by 73.392 of this part, be labeled with a properly executed label as described in 73.414 (b) of this part.

**73.395. Cleaning Cars and Vehicles:**

(a) Any box car or motor vehicle which, after use for the transportation of radioactive materials in carload or truckload lots, is contaminated with such materials to the extent that a survey of the interior surface shows that the beta-gamma radiation is greater than 10 milliroentgens physical equivalent in 24 hours or that the average alpha contamination is greater than 500 disintegrations per minute per 100 square centimeters shall be thoroughly cleaned in such a manner that a resurvey of the interior surface shows the contamination to be below these levels. A certificate to that effect must be furnished to the local agent of the carrier or to the driver of the motor vehicle. Cars and motor vehicles which are used solely for the transportation of radioactive materials are exempt from the provisions of this section.”\*

See also paragraph 74.566 (d).

**73.396. Radioactive materials handling:**

(a) When radioactive materials are loaded into railroad cars or motor vehicles by the shipper, the shipper shall observe all applicable requirements of 75.655 (j) or 77.841 (d), as the case may be.

**Subpart H.—Marking and labeling explosives and other dangerous articles**

**73.401. Dangerous articles:**

(a) Packages containing flammable liquids, flammable solids, oxidizing materials, corrosive liquids, compressed gases, and poisons, as defined in this part must be marked, unless exempted, with the proper shipping name as shown in the commodity list (see 72.5). . . .

\* \* \* \* \*

(d) Each package must show the specification marking as required if a specification container is prescribed.

(e) Additional shipping information not inconsistent with Parts 71-78 may be shown on a container if so desired but no such label or marking shall be of a design, or form, or size, as may be confused with the marking required by Parts 71-78.

**73.402. Labeling dangerous articles:**

(a) Each package containing any dangerous article as defined in Parts 71-78 must be conspicuously labeled by the shipper as follows, except as otherwise provided:

(1) “Red label” as described in 73.405 on containers of flammable liquids, except when exempted from the regulations by

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\*Revised May 3, 1955.

73.118. If flammable liquid is also a class A poison or a radioactive material poison D, the "poison gas" label or "radioactive materials" label must also be applied to the package.

(2) "Yellow label" as described in 73.406 on containers of flammable solids and oxidizing materials, except when exempted from the regulations by 73.153 and 73.183. If flammable solid or oxidizing material is also a class A poison or a radioactive material poison D, the "poison gas" label or "radioactive materials" label must also be applied to the package.

(3) "White label" as described in 73.407 (a) (1), (2) and (3) on containers of acids, alkaline caustic liquids or corrosive liquids, except when exempted from regulations by 73.244. If the acid, alkaline caustic liquid or corrosive liquid is also a class A poison or a radioactive material poison D, the "poison gas" label or "radioactive materials" label must also be applied to the package.

(4) "Red label" as described in 73.408 (a) (1) on containers of flammable compressed gases, except when exempted from the regulations by 73.302. If the flammable compressed gas is also a class A poison or a radioactive material poison D, the "poison gas" label or "radioactive materials" label must also be applied to the package.

(5) "Green label" as described in 73.408 (a) (2) on containers of nonflammable compressed gases, except when exempted from the regulations by 73.302. If the nonflammable compressed gas is also a class A poison or a radioactive material poison D, the "poison gas" label or "radioactive materials" label must also be applied to the package.

(6) "Poison gas" label as described in 73.409 (a) (1) on containers of class A poisons.

(7) "Poison" label as described in 73.409 (a) (2) on containers of class B poison liquids or solids, except when exempted from the regulations by 73.345 and 73.364. If the class B poison liquid or solid is also a radioactive material poison D, the "radioactive materials" label must also be applied to the package.

(8) "Radioactive Materials" label as described in 73.414 (a) on containers of class D poisons, Group I and II except when exempted by 73.392.

(9) "Radioactive Materials" label as described in 73.414 (b) on containers of class D poisons, Group III, except when exempted by 73.392.

\* \* \* \* \*

(12) "Empty label" as described in 73.413 of this part must be applied to containers which have been emptied and on which the

old label has not been removed, obliterated, or destroyed. It must be so placed on the container as to completely cover the old label.

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*73.403. Labels for mixed packing:*

(a) Use red label only when red and other labels are prescribed, except when poison gas label or radioactive materials label are prescribed—then both the red label, the poison gas label, or red label and radioactive materials label must be used.

(b) Use white acid (alkaline caustic liquid or corrosive liquid) label only when white acid (alkaline caustic liquid or corrosive liquid) and yellow or poison labels are prescribed or poison labels (class B) are prescribed, except when poison gas label or radioactive materials label are prescribed, then both the white acid label and the poison gas label or white acid and radioactive materials label must be used.

(c) Use yellow label only when yellow and poison labels are prescribed except when poison gas label or radioactive materials label are prescribed then both the yellow label and the poison gas label or the yellow label and the radioactive materials label must be used.

*73.404. Labels:*

(a) Shippers must furnish and attach the labels prescribed for their packages. Labels should be applied to that part of the package bearing consignee's name and address.

(b) Labels must not be applied to packages containing articles which are not subject to Parts 71-78 or are exempted therefrom.

(c) Shippers must not use labels which by their size, shape, and color, may readily be confused with the standard caution labels prescribed in this part.

(d) Labels must conform to standards as to size, printing, and color, and samples will be furnished, on request, by the Bureau of Explosives.

(e) A combination diamond-shaped label-tag of proper size and color, bearing on one side the shipping information and on the reverse side the wording prescribed in this part, will be permitted.

(f) As certification of compliance with regulations is also required by other Government agencies, and to avoid multiplicity of certifications, there may be added to the certificate on labels "and the Commandant of the Coast Guard," or "and the Civil Air Regulations," or "and the Post Office Department," as is necessary.

(g) The carrier's name and stationery form number, or the shipper's name and address, may be printed on the labels, in type not larger than 10 point, if placed within the black-line border and in the upper or lower corner of the diamond.

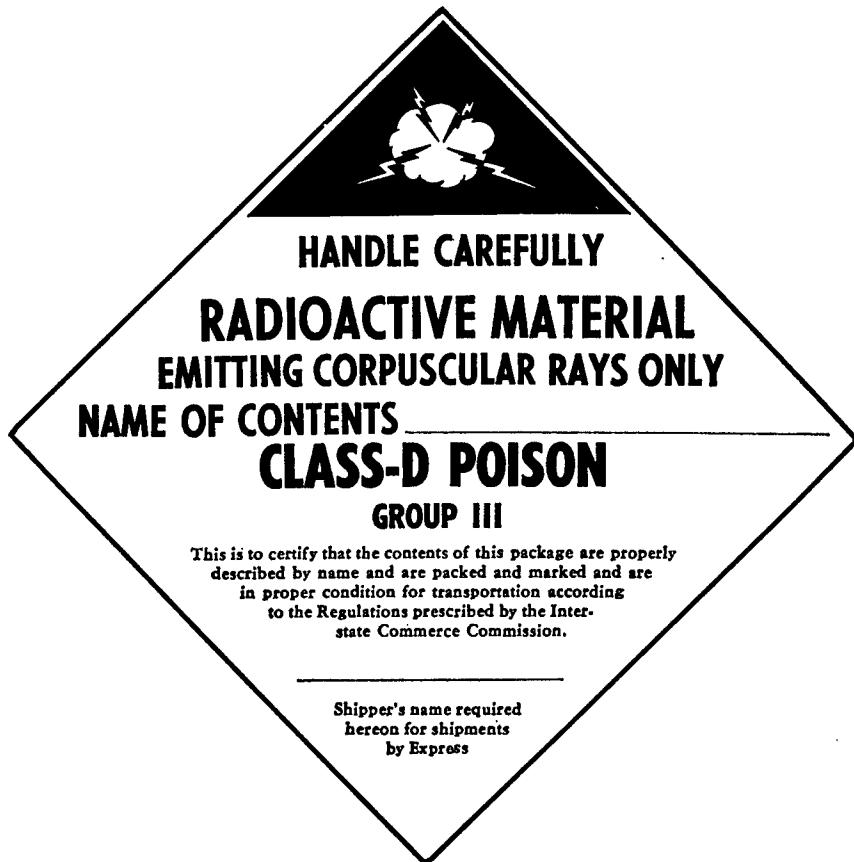


73.414. *Radioactive materials labels:*

(a) Labels for radioactive materials (class D poisons) Group I and Group II must be of diamond shape, white in color, and with each side 4 inches long. Printing must be in red letters inside of a red-line border measuring 3½ inches on each side, as shown in this section.

NOTE.—This label must be duly executed by the shipper and the number of radiation units must be shown. For purposes of these regulations 1 unit equals 1 milliroentgen per hour at 1 meter for hard gamma radiation or the amount of radiation which has the same effect on film as 1 mrhm of hard gamma rays of radium filtered by ½ inch of lead.

(b) Labels for radioactive materials (class D poisons) Group III must be of diamond shape, white in color, and with each side 4 inches long. Printing must be in blue letters inside of a blue-line border measuring 3½ inches on each side, and as shown in this section.



*73.427. Shipping order and bill of lading description:*

(a) The shipper when offering for transportation by carriers by rail freight, rail express, highway, or water any class A, class B, or class C explosive, flammable liquid, flammable solid, oxidizing material, corrosive liquid, compressed gas, or poison, as defined by this part, must describe such article in the shipping order, bill of lading or other shipping paper by the shipping name used in 72.5 (see commodity list) and may add a further description not inconsistent therewith. Abbreviations must not be used. . . .

The commodity list given in section 72.5 indicates that all radioactive materials should be entered on shipping papers as "radioactive materials." The group classification, as defined by paragraph 73.391 (a) should be added to this description.

*73.428. Label or placard notation:*

(a) The shipping order, bill of lading or other shipping paper must also show thereon in connection with the entry of the article as prescribed in 73.427 of this part, the color or kind of label ap-

plied, and for cars containing such articles loaded by the shipper, requiring placards the kind of placard applied to the car.

Labels applied to packages of radioactive material should be identified by color; i. e., as *red* or *blue*.

**73.430. Certificate:**

(a) The shipper offering for transportation by carriers by rail freight, highway, water, or air, any class A or class B explosive and blasting caps or electric blasting caps in any quantity, and any flammable liquid, flammable solid, oxidizing material, corrosive liquid, compressed gas, or poison, requiring labels, or carloads requiring placards, as prescribed by Parts 71-78, must show on the shipping order, bill of lading, or other shipping paper, in the lower left-hand corner, the following certificate over the written or stamped facsimile signature of the shipper or his duly authorized agent:

This is to certify that the above-named articles are properly described, and are packed and marked and are in proper condition for transportation according to the regulations prescribed by the Interstate Commerce Commission.

(b) For the relief of shippers from multiplicity of certifications required for packages which may move by various means of transportation, shipments may be certified for rail, motor vehicle, water, or air transportation by adding to the certificate required on the shipping document "and the Commandant of the Coast Guard," or "and the Civil Air Regulations," as the case may be.

**Part 74.—Regulations Applying Particularly to Carriers by Rail Freight**

**Subpart A.—Loading, unloading, placarding and handling cars; loading packages into cars**

**73.532. Loading other dangerous articles into cars:**

(a) Shipments must be properly loaded in closed cars, except as otherwise provided in Parts 71-78 and cars placarded as prescribed, when accepted by carriers.

\* \* \* \* \*

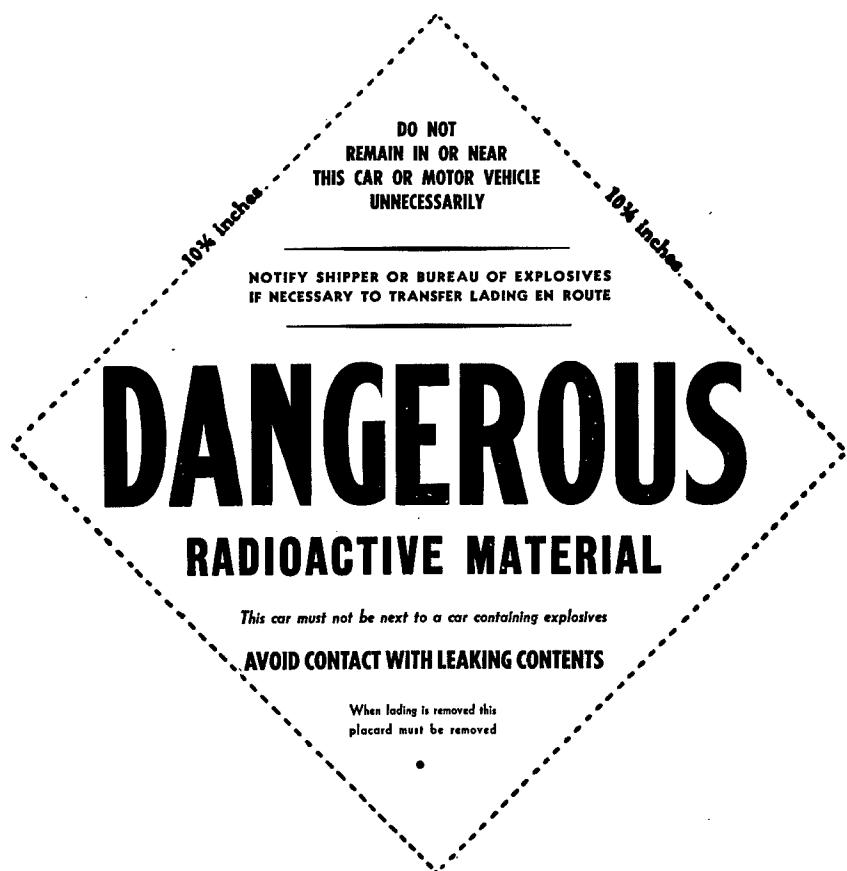
(j) Radioactive ores, residues, and similar material: Shipment of radioactive ores, residues, or similar material as provided in 73.392, must be so loaded as to avoid spillage and scattering of loose material.

(1) The amount of radioactive material loaded in a car must be limited as provided in 73.392.

(2) No persons shall remain in a car containing radioactive material unnecessarily and the shipper must furnish the carrier

# DANGEROUS PLACARD FOR CLASS D POISONS

(Reduced size)



with such information and equipment as is necessary for the protection of the carrier's employees.

(3) Any loose radioactive material must be removed from the car and placed in a closed container in a segregated location and held for instructions from the shipper or the Bureau of Explosives.

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## Subpart C.—Placards on cars

74.541. "Dangerous" placards; "Dangerous—Radioactive Material" placards;

\* \* \* \* \*

(b) "Dangerous—Radioactive Material" placards, as prescribed in 74.553 must be applied to cars containing shipments of class D poisons as provided in 73.391 and 73.392.

**74.553 Dangerous—Class D Poison placard:**

(a) The "Dangerous—Radioactive Materials" placard for class D poisons, must be of diamond shape measuring 10 $\frac{3}{4}$  inches on each side, and must bear the wording in red letters as shown on page 27.

**74.554. Unauthorized use of placards.**

(a) Placards prescribed by this part must not be applied to cars containing articles not subject to Parts 71-78 or specifically exempted therefrom.

**Subpart D.—Unloading from cars**

**74.566. Cleaning cars:**

(d) Any box car which, after use for the transportation of radioactive materials in carload lots, is contaminated with such materials to the extent that a survey of the interior surface shows that the beta-gamma radiation is greater than 10 milliroentgens physical equivalent in 24 hours or that the average alpha contamination is greater than 500 disintegrations per minute per 100 square centimeters shall be thoroughly cleaned in such a manner that a resurvey of the interior surface shows the contamination to be below these levels. A certificate to that effect must be furnished to the local agent of the carrier. Cars which are used solely for the transportation of radioactive materials are exempt from the provisions of this section.\*

**74.597. Leaking packages of acid or poisons:**

\* \* \* \* \*

(e) *Radioactive materials.*—*Poison Class D.*—In event of breakage of container, wreck, fire, or unusual delay involving cars placarded "Dangerous—Radioactive Material" as prescribed in 74.541 (b) of this part, the car and any loose radioactive material must be isolated as far as possible from danger of human contact and no persons must be allowed to remain close to the car or contents needlessly until qualified persons are available to supervise handling. The shipper and the Bureau of Explosives should be notified immediately.

(1) Cars, buildings, area, or equipment in which class D poisons have been spilled must not be again placed in service or occupied until decontaminated by qualified persons.

**Part 76.—Regulations Applying to Rail Carriers in Baggage Service**

**76.702. Dangerous articles.**

(a) No dangerous article described by Parts 71-78 shall be accepted for transportation or transported in rail baggage service except as provided for in 76.703 of this part. . . .

\*Revised May 8, 1955.

The list of acceptable articles given in 76.703 does not include radioactive materials.

**Part 77.—Regulations Applying to Shipments Made by Way of Common, Contract, or Private Carriers by Public Highway**

**Subpart A.—General information and regulations**

*77.802. Application of regulations in Parts 71-78:*

(a) Parts 71-78 apply to all common and contract carriers by motor vehicle transporting explosives and/or other dangerous articles as defined by Interstate Commerce Commission "Regulations for Transportation of Explosives and Other Dangerous Articles by Land and Water in Rail Freight, Express and Baggage Services and by Motor Vehicle (Highway) and Water." When shipments are accepted by motor vehicle for further transportation by rail express . . . , rail freight or by water on board vessel, they must in addition to Parts 71-78, comply with the applicable regulations for the service by which they are to be transported.

\* \* \* \* \*

*77.815. Labels:*

(a) Labels prescribed by the Commission's regulations, Part 73, must have been applied to shipments, unless exempt from Parts 71-78, and in addition the shipper must have certified to compliance with the regulations by writing, stamping, or printing his name underneath the certificate printed thereon or on the shipping papers.

\* \* \* \* \*

*77.823. Marking on motor vehicles and trailers other than tank motor vehicles:*

(a) Except as otherwise provided in Part 73, every motor vehicle transporting explosives or other dangerous articles must be marked or placarded as follows:

\* \* \* \* \*

(3) Every motor vehicle transporting any quantity of radioactive material, class D poison, requiring red radioactive materials label must be marked or placarded "DANGEROUS—RADIOACTIVE MATERIALS" on each side and rear with a placard or lettering in letters not less than 3 inches high on a contrasting background.

(4) Every motor vehicle transporting 2,500 pounds gross weight or more of explosives class B, flammable liquids, flammable solids, oxidizing materials, acids or other corrosive liquids, compressed gases (see Note 1), class B poisons, class C poisons, and class D poisons not requiring red radioactive materials label must be marked or placarded "DANGEROUS" on each side and rear with a

placard or lettering in letters not less than 3 inches high on a contrasting background: Provided, however, that if such articles are, because of size and kind of containers, exempted from the packaging, marking, and labeling requirements of Part 73, and provided such exempted commodities do not have a gross weight (contents and containers) exceeding 5,000 pounds, the provisions of this subparagraph shall not be applicable. . . .

#### Subpart B.—Loading and unloading

##### 77.841. Poisons.

\* \* \* \* \*

(d) *Radioactive material.*—A container of radioactive material bearing radioactive material, red label, must not be placed in vehicles, terminals, or other places closer than 3 feet to an area which may be continuously occupied by passengers, employees, or shipments of animals. When more than one such container is present, the distance from occupied areas must be computed from the table in subparagraph (1) of this paragraph by adding the number of units shown on labels on the containers.

\* \* \* \* \*

(2) Not more than 40 units of radioactive material, red label, shall be transported in any vehicle or stored in any location at one time. Packages must be so blocked or braced in vehicles as to prevent any shift of lading under conditions normally incident to transportation.

\* \* \* \* \*

#### Subpart D.—Vehicles and shipment in transit: Accidents

##### 77.860. Accidents; poisons:

(d) *Cleaning vehicles.*—Any motor vehicle which, after use for the transportation of radioactive materials in truckload lots, is contaminated with such materials to the extent that a survey of the interior surface shows that the beta-gamma radiation is greater than 10 milliroentgens physical equivalent in 24 hours or that the average alpha contamination is greater than 500 disintegrations per minute per 100 square centimeters shall be thoroughly cleaned in such a manner that a resurvey of the interior surface shows the contamination to be below these levels. A certificate to that effect must be furnished the carrier or to the driver of the motor vehicle. Motor vehicles which are used solely for the transportation of radioactive materials are exempt from the provisions of this section.\*

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\*Revised May 3, 1955.

Subpart E.—Regulations applying to explosives or other dangerous articles on  
motor vehicles carrying passengers for hire

77.870. *Regulations for passenger-carrying vehicles:*

\* \* \* \* \*

(g) *Radioactive materials on passenger-carrying vehicles.*—No motor carrier may transport any radioactive material, poison, class D, requiring red or blue radioactive material label under these regulations in or on any bus while engaged in the transportation of passengers except where no other practicable means of transportation is available. Packages of radioactive materials must be handled and placed in the vehicle in accordance with the requirements of 77.841 (d) of this part.

## *Chapter III*

### **CIVIL AIR REGULATIONS GOVERNING THE TRANSPORTATION OF RADIOACTIVE MATERIALS**

The transportation of radioactive materials by air is regulated by the Civil Aeronautics Board. Its Civil Air Regulations covering the Transportation of Explosives and Other Dangerous Articles constitutes Part 49 of Title 14 of the Code of Federal Regulations. Those regulations of particular interest to shippers of radioactive materials are excerpted below.

Many of the Civil Air Regulations applying to the shipment of radioactive materials—especially those applying to packaging, marking, or labeling of such materials—are based on ICC regulations. Comments made in Chapter II on ICC regulations are not repeated here. The few comments made in this chapter are distinguished from the text of the excerpts as in Chapter II. Limitations on the nature of these comments are given on page 1, Chapter I.

#### **Part 49.—Transportation of Explosives and Other Dangerous Articles**

##### **49.0 *Applicability of part:***

Explosives or other dangerous articles, including flammable liquids, flammable solids, oxidizing materials, corrosive liquids, compressed gases, and poisonous substances, shall not be loaded in or transported by civil aircraft in the United States, or transported anywhere in air commerce in civil aircraft of United States registry except as hereinafter provided.

##### **49.1. *Definitions:***

(a) As used in this part the words listed below shall be defined as follows:

7 (iv) *Radioactive materials—Class D.*—A radioactive material is any material or group of materials which spontaneously emits ionizing radiation. For the purpose of these rules, radioactive materials are divided into three groups according to the type of radiation emitted at any time during transportation as follows:

(I) *Group I radioactive materials.*—Group I radioactive materials are those materials which emit any gamma radiation, either alone or with electrically charged particles or corpuscles.

(II) *Group II radioactive materials.*—Group II radioactive materials are those materials which emit neutrons and either or both of the types of radiation characteristic of Group I radioactive materials.

(III) *Group III radioactive materials.*—Group III radioactive materials are those materials which emit only electrically charged particles or corpuscles (i. e., alpha and/or beta radiation).

The above definitions of Group I and Group III materials differ slightly from the ICC definitions. (See 73.391 (a), page 12.)

(8) "Unit" of gamma radiation. "Unit" of gamma radiation is one milliroentgen per hour at a meter for "hard gamma" radiation, i. e., that amount of gamma radiation which will have the same effect on sensitive photographic film as one milliroentgen per hour at a meter of "hard gamma" radiation of radium filtered through  $\frac{1}{2}$  inch of lead.

See page 16 for comments on filtration of radiation.

(10) Cargo aircraft. A cargo aircraft is an aircraft other than a passenger-carrying aircraft which is carrying goods or property.

(11) Marking. Marking is the display on the container of the name of the articles inside as listed in the commodity list of the ICC Regulations.

(12) Labeling. Labeling is the display on the container of an appropriate label as specified for a particular class of articles by the ICC Regulations.

(13) ICC Regulations. ICC Regulations shall mean the "Interstate Commerce Commission's Regulations for Transportation of Explosives and Other Dangerous Articles," effective January 7, 1941, as amended or revised from time to time.

(14) Aircraft operator. An operator of aircraft shall include the owner, lessee, or any other person who causes or authorizes the operation of the aircraft.

#### 49.3. *Packing, marking, and labeling requirements:*

(a) Unless otherwise specifically provided in this part, explosives or other dangerous articles shipped by air shall be packed, marked, and labeled in accordance with the specifications established in Part 72<sup>4</sup> of the ICC Regulations for transportation by rail express: *Provided*, That liquids shall be packed only in containers which are securely closed, sufficient strength to prevent any leakage or distortion of the containers caused by change in temperature or

<sup>4</sup> Part 72 of the ICC Regulations incorporates the packaging specifications of Part 73 thereof. It will be noted that items exempted from the packaging, labeling, or marking provisions of Part 73 of the ICC Regulations are *not* exempted from such requirements for shipment by air unless it is expressly so provided in this part.

altitude during transit, and so filled as to provide adequate outage. All explosives or other dangerous articles shipped by air shall show the proper shipping name as shown in the commodity list of Part 72 of the ICC Regulations and any instructions that are necessary for safe handling.

(b) No shipper shall offer and no air carrier or other operator of aircraft shall knowingly accept explosives or dangerous articles for carriage

by air unless the shipper or his authorized agent has certified that the shipment complies with the requirements of this part. No shipment shall be accepted for transportation by passenger-carrying aircraft unless the package shows a clear and plainly visible statement that it is within the limitations prescribed for passenger operations. Any operator of aircraft may rely on such a certificate as *prima facie* evidence that the shipment so certified complies with the requirements of this part.<sup>5</sup>

The first of the statements given in footnote 5 below appears on the radioactive material labels prescribed by the Interstate Commerce Commission, paragraphs 73.414 (a) and (b).

#### **Passenger-Carrying Aircraft**

**49.10. Acceptable explosives and other dangerous articles on aircraft carrying passengers:** No article listed in Appendices A or B of this part shall be carried on passenger-carrying aircraft, and no other explosives or dangerous article shall be carried in passenger-carrying aircraft except as provided in paragraph 49.11 through 49.18.

**49.18. Radioactive materials:** Radioactive materials—Class D, Groups I, II, and III (liquid, solid, or gaseous) may be carried when packed, marked, and labeled in accordance with the provisions of paragraphs 73.368 through 73.369 of the ICC Regulations. (See paragraph 49.55 for handling of radioactive materials in aircraft. See also paragraph 49.62 where certain other types of radioactive materials are exempted from certain of the requirements of this part.)

As the ICC Regulations are now numbered, the paragraphs containing provisions for packing, marking, and labeling of radioactive materials are 73.391 through 73.394.

#### **Cargo Aircraft**

**49.41. Articles which may be carried in cargo aircraft:** In addition to the articles acceptable for transportation on aircraft carrying passen-

<sup>5</sup> The following statement on a shipping label signed by a responsible agent of the shipper will be accepted as meeting this requirement: This is to certify that the contents of this package are properly described by name and are packed and marked and are in proper condition for transportation according to the regulations prescribed by the Interstate Commerce Commission and the Civil Aeronautics Board.

For shipment on passenger-carrying aircraft add the following: This shipment is within the limitations prescribed for passenger-carrying aircraft.

gers, any article acceptable for, and packed, marked, and labeled in accordance with the ICC Regulations for transportation by rail express may be carried in cargo aircraft: Provided, That no article listed in Appendix A of this part shall be carried except under the provisions of 49.71. The maximum quantity in any one outside package or container shall not exceed that prescribed in the commodity list of Part 72 of the ICC Regulations.

The commodity list of Part 72 of the ICC Regulations lists the "Maximum quantity in 1 outside container by rail express" for radioactive materials as follows: "2000 millicuries. See 73.391 (c)." (73.391 (c) is excerpted on page 13.)

#### Exempted Articles

##### 49.62. *Radioactive materials:*

(a) Radioactive materials which meet all of the following conditions are exempt from packing, marking, and labeling requirements required by this part:

(1) The package shall be such that there can be no leakage of radioactive material under conditions normally incident to transportation.

(2) The package shall contain not more than 0.1 millicuries of radium, or polonium, or that amount of strontium 89, strontium 90, or barium 140 which disintegrates at a rate of more than 5 million atoms per second; or not more than that amount of any other radioactive substance which disintegrates at a rate of more than 50 million atoms per second.

(3) The package shall be such that no significant alpha, beta, or neutron radiation is emitted from the exterior of the package, and the gamma radiation at any surface of the package shall be less than 10 milliroentgens in 24 hours.

(b) Manufactured articles other than liquids, such as instrument or clock dials of which radioactive materials are a component part, and luminous compounds when securely packed in strong outside containers are exempt from packing, marking, and labeling requirements, provided the gamma radiation at any surface of the package is less than 10 milliroentgens in 24 hours.

(c) (1) Radioactive materials, such as ores, residues, etc., packed in strong, tight containers are exempt from packing and labeling requirements for shipment in planeload lots, provided the per-plane-load (as loaded in place in the airplane) does not exceed 10 milliroentgens per hour of gamma radiation or equivalent. There shall be no loose radioactive material in the airplane, and the shipment must be braced and lashed so as to prevent leakage or shift of lading under normal conditions of flight.

(2) It is the responsibility of the consignor and/or consignee to supervise, respectively, all loading and unloading operations and to monitor all personnel involved so that the accepted limits of personnel radiation exposure are not exceeded.

(d) Shipments of radioactive materials made by the Atomic Energy Commission or under its direction or supervision, which are escorted by personnel who are specially designated by the Atomic Energy Commission, are exempted from the provisions of these regulations where special arrangements are made with and approved by the Administrator.

See pages 8 and 9 for discussion of a similar provision in the ICC Regulations, 73.7 (b). Note also that although ICC Regulations do not require special arrangement for such exemption, Civil Air Regulations do require such arrangements.

**49.71. Special Authority:**

In emergency situations or where other forms of transportation are impracticable:

(a) Deviations from any of the provisions of this part for a particular flight may be authorized by the Administrator where he finds that the conditions under which the articles are to be carried are such as to permit the safe carriage of persons and cargo.

(b) Deviations from the 2,000 millicurie quantity limitation prescribed for radioactive materials by Paragraph 49.18 may be taken by the Atomic Energy Commission for Atomic Energy Commission shipments, provided that such shipments are made in accordance with the requirements approved by the Interstate Commerce Commission for shipment by rail express and prior notification of each shipment is given by the Atomic Energy Commission in the form and manner prescribed by the Administrator.\*

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\*Revised May 8, 1955.

## *Chapter IV*

### **U. S. COAST GUARD REGULATIONS GOVERNING THE TRANSPORTATION OF RADIOACTIVE MATERIALS**

The following regulations of the U. S. Coast Guard governing the packaging, marking, and labeling of radioactive materials transported by water are excerpted from Title 46, Part 146, of the Code of Federal Regulations. It will be observed that they are in very close agreement with the corresponding ICC Regulations excerpted in Chapter II.

#### **Part 146.—Regulations of the U. S. Coast Guard Covering the Transportation or Storage of Explosives or Other Dangerous Articles or Substances and Combustible Liquids on Board Vessels**

##### **146.02-8. U. S. Government Shipments:**

(b) Shipments of radioactive materials, made by the Atomic Energy Commission, or under its direction or supervision, which are escorted by personnel specially designated by the Atomic Energy Commission, are exempt from the regulations in this part.

##### **146.05-15. Marking and Labeling Applying to Domestic Shipments Only:**

(g) Each package containing "Any Other Dangerous Article" as defined by the regulations in this part shall be conspicuously labeled by the shipper as follows, except as otherwise provided:

(11) "Radioactive materials label" as described and illustrated in paragraph 146.05-17 (q) on containers of Group I and Group II radioactive materials. (See illustration on page 22, Chapter II.)

(12) "Radioactive materials label" as described and illustrated in paragraph 146.05-17 (r) on containers of Group III radioactive materials. (See illustration on page 23, Chapter II.)

##### **146.05-17. Labels:**

(a) Shipper shall furnish and attach the labels prescribed for their packages.

(d) Labels shall conform to standard as required by Interstate Commerce Commission regulations.

(e) A combination diamond-shaped label-tag of proper size and color, bearing on one side the shipping information and on the reverse side the wording prescribed in this section, will be permitted.

**Subpart E.—Detailed regulations governing poisonous articles**

**146.25-1. *Definition of poisonous articles:***

(a) Poisonous articles are divided by the Interstate Commerce Commission regulations into four classes according to degree of hazard in transportation. These are:

Extremely dangerous poisons—Class A.

Less dangerous poisons—Class B.

Tear gases or irritating substances—Class C.

Radioactive materials—Class D.

(b) These poisonous articles are defined by the Interstate Commerce Commission regulations as set forth in paragraphs 146.25-5, 146.25-10, 146.25-15, and 146.25-20, and such definitions are binding upon all shippers making shipments of poisonous articles by common carrier vessels engaged in interstate or foreign commerce by water. These definitions are accepted and adopted and form part of the regulations in this subchapter and apply to all shippers making shipments of poisonous articles by any vessel and shall apply to owners, charterers, agents, master or other person in charge of a vessel, and to other persons, transporting, carrying, conveying, storing, stowing, or using poisonous articles on board vessels subject to R. S. 4472, as amended (46 U. S. C. 170), and the regulations in this subchapter.

**146.25-20. *Radioactive materials, Class D, radioactive materials label:***

(a) Radioactive material is any material or combination of materials that spontaneously emits ionizing radiation. For the purpose of the regulations in this part radioactive materials are divided into 3 groups according to the type of rays emitted at any time during transportation, as follows:

(1) *Group I.*—Radioactive materials that emit gamma rays only or both gamma and electrically charged corpuscular rays.

(2) *Group II.*—Radioactive materials that emit neutrons and either or both types of radiation characteristic of Group I materials.

(3) *Group III.*—Radioactive materials that emit electrically charged corpuscular rays only, i. e., alpha or beta, etc., or any other radioactive material that is so shielded that the gamma radiation at the surface of the package does not exceed 10 milliroentgens\* per 24 hours at any time during transportation.

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\*In determining compliance with requirements of these regulations, all measurements of radiation must be made with a Landsverk-Wollan Electrometer Model L-100, or equally efficient standardized meter.

146.25-25. *Exemptions for radioactive materials:*

(a) Radioactive materials are exempt from prescribed packaging, marking other than the name of the contents, and labeling requirements, provided they fulfill all of the following conditions:

(1) The package must be such that there can be no leakage of radioactive materials under conditions normally incident to transportation.

(2) The package must contain not more than 0.1 millicuries\*\* of radium, or polonium or that amount of strontium 89, strontium 90, or barium 140 which disintegrates at a rate of more than 5 million atoms per second; or that amount of any other radioactive substance which disintegrates at a rate of more than 50 million atoms per second.

(3) The package must be such that no significant alpha, beta, or neutron radiation is emitted from the exterior of the package, and the gamma radiation at any surface of the package must be less than 10 milliroentgens per 24 hours.

(b) Manufactured articles other than liquids, such as instrument or clock dials of which radioactive materials are a component part, and luminous compounds, when securely packed in strong outside containers are exempted from specification packaging, marking other than name of contents, and labeling requirements provided the gamma radiation at any surface of the package is less than 10 milliroentgens per 24 hours.

(c) Radioactive materials, such as ores, residues, etc., of low activity, packed in strong tight containers, are exempt from specification packaging, marking other than name of contents, and labeling requirements for transportation on board vessels only if the gamma radiation or equivalent at any point in any space or area continuously occupied by passengers, crew, or shipments of animals, will not exceed 40 milliroentgens per 24 hours at any time during transportation.

146.25-30. *Packing and shielding of radioactive materials:*

(a) Not more than 2,000 millicuries of radium, polonium, or other members of the radium family of elements, and not more than that amount of any other radioactive substance which disintegrates at a rate of 100,000 million ( $10^{11}$ ) atoms per second may be packed in one outside container for transportation on board vessels, except by special arrangements and under conditions approved by the Commandant of the Coast Guard.

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\*\*For purposes of the regulations in this part 1 millicurie is that amount of any radioactive material which disintegrates at the rate of 37 million atoms per second.

(b) Radioactive materials that present special hazards due to their tendency to remain fixed in the human body for long periods of time (i. e., radium, plutonium, and radioactive strontium, etc.) must, in addition to the packing prescribed in this subpart, be packed inside metal containers (ICC specification 2R) or other containers approved by the Bureau of Explosives, and authorized by the Commandant of the Coast Guard.

(c) All radioactive materials must be so packed and shielded that the degree of fogging of undeveloped film under conditions normally incident to transportation (24 hours at 15 feet from the package) will not exceed that produced by 11.5 milliroentgens of penetrating gamma rays of radium filtered through  $\frac{1}{2}$  inch of lead.

(d) The design and preparation of the package must be such that there will be no significant radioactive surface contamination of any part of the container.

(e) The smallest dimension of any outside shipping container for radioactive materials must not be less than 4 inches.

(f) All outside shipping containers must be of such design that the gamma radiation will not exceed 200 milliroentgens per hour or equivalent at any point of readily accessible surface. Containers must be equipped with handles and protective devices when necessary in order to satisfy this requirement.

(g) The outside shipping container for radioactive material, unless specifically exempt by paragraph 146.25-25 (a), (b), or (c), must be a wooden box (ICC specification 15A or 15B), a fiber drum (ICC specification 21A), or a fiberboard box (ICC specification 12B), except that equally efficient containers may be used when approved by the Bureau of Explosives and authorized by the Commandant of the Coast Guard.

(h) Radioactive materials, Group I, liquid, solid, or gaseous, must be packed in suitable inside containers completely surrounded by a shield of lead or other suitable material of such thickness that at any time during transportation the gamma radiation will not exceed 10 milliroentgens per hour at a distance of one meter (39.3 inches). The shield must be so designed that it will not break or open under conditions incident to transportation. The minimum shielding must be sufficient to prevent the escape of any primary corpuscular radiation to the exterior of the outside shipping container.

(j) (1) Radioactive materials, Group II, liquid, solid, or gaseous, must be packed in suitable inside containers completely shielded so that at any time during transportation the radiation measured at right angles to any point on the long axis of the shipping container will not exceed the following specified limits:

- (i) Gamma radiation of 10 mrhm.
- (ii) Electrically charged corpuscular radiation which is the physical equivalent\* of 10 mrhm. of gamma radiation.
- (iii) Neutron radiation which is the physical equivalent of 2 mrhm. of gamma radiation.
- (iv) If more than one of type of radiation named in subdivisions (i), (ii), and/or (iii) of this subparagraph is present, the radiation of each type must be reduced by shielding so that the total does not exceed the equivalent of subdivision (i), (ii), or (iii) of this subparagraph.

(2) The shielding must be designed so as to maintain its efficiency under conditions normally incident to transportation and must provide personnel protection against fast or slow neutrons and all other ionizing radiation originating in the radioactive materials or any part of the aggregate constituting the complete package.

\*For the purposes of the regulations in this part the "Physical Equivalent" of a roentgen is that dose of any ionizing radiation which results in the absorption in tissue of ionizing energy equivalent to 93 ergs per gram of tissue. This is approximately the dose which is imparted to soft tissue by 1 roentgen of gamma or X-rays but it may be imparted by corpuscular radiation which is not measured in terms of roentgens.

## *Chapter V*

### **U. S. POSTAL REGULATIONS COVERING THE TRANSPORTATION OF RADIOACTIVE MATERIALS**

The following regulations covering the transportation of radioactive materials by mail are excerpted from Part I of the U. S. Postal Guide, Article 37, Chapter IV, 1951.

#### *37. Radioactive materials:*

(a) Radioactive materials requiring a caution label under Interstate Commerce Commission regulations are prohibited. But certain of these materials which are exempt from specification packing, marking, and labeling requirements under Interstate Commerce Commission regulation 73.392 Explosives and other Dangerous Articles, may be admitted to the mails if packed and labeled in accordance with paragraphs (b) to (f).

All prospective mailers of these materials are cautioned that mailings must be within the amount specified and postmasters shall assure themselves of the fact that the mailer is in a position to determine definitely the radiation of any proposed mailing before it is accepted.

(b) Radioactive materials (liquid, solid, or gaseous; manufactured articles such as instrument or clock dials of which radioactive materials are a component part; luminous compounds; ores and residues) which fulfill all the following conditions shall be accepted for mailing provided they are packed in a strong, tight outside container and marked "Radioactive Material—Gamma Radiation at Surface of Parcel Less than 10 Milliroentgens for 24 hours—No significant Alpha, Beta, or Neutron Radiation."

(c) The package must be such that there can be no leakage of radioactive material under conditions normally incident to transportation in the mails in sacks.

(d) The package must contain not more than 0.1 millicuries of radium, or polonium, or that amount of strontium 89, strontium 90, or barium 140 which disintegrates at a rate of more than 5 million atoms per second; or that amount of any other radioactive substance which disintegrates at a rate of more than 50 million atoms per second.

(e) The package must be such that no significant alpha, beta, or neutron radiation is emitted from the exterior of the package and

the gamma radiation at any surface of the package must be less than 10 milliroentgens for 24 hours.

(f) The design and preparation of the package of radioactive material must be such that there will be no significant radioactive surface contamination of any part of the container. Liquids must be packed in tight glass, earthenware, or other suitable inside containers surrounded by an absorbent material sufficient to absorb the entire liquid contents and of such nature that its efficiency will not be impaired by chemical reaction with the contents.

NOTE.—The amounts of radioactive materials shown are based on exemptions to Interstate Commerce Commission regulation 73.392, while packaging requirements are based on Interstate Commerce Commission regulation 73.393.

## *Chapter VI*

### **AUXILIARY INFORMATION FOR SHIPPERS**

*Regulations Pertaining Particularly to Carriers.* There are certain sections of the various Regulations\* not of direct concern to shippers or consignees. They are of interest, however, since they may influence the manner of shipment or involve the shipper or consignee in responsibility, for example:

#### **A. ICC Regulations:**

- Part 74.—Regulations Applying to Carriers by Rail Freight.
- Part 75.—Regulations Applying to Carriers by Rail Express.
- Part 76.—Regulations Applying to Rail Carrier in Baggage Service (LCL Movements).
- Part 77.—Regulations Applying to Shipments Made by Way of Common, Contract, or Private Carriers by Public Highway (Motor Carriers).

#### **B. Civil Aeronautics Board Regulations:**

- 49.51 through 49.55. Loading and Handling Requirements (Commercial and Contract Air Lines regulated by the C. A. B.).

#### **C. Coast Guard Regulations:**

- 146.02-13 Report Fires.
- 146.02-14 Damaged Containers.
- 146.02-15 Emergency Shipments.
- 146.02-16 Shipments in Violation.
- 146.20-90 Stowage and Storage Chart of Dangerous Articles.
- 146.25-35 Stowage and Handling Aboard Vessels.
- 146.25-45 Limitation on All Stowage.
- <sup>1</sup>146.25-50 Care Following Leakage or Sifting of Poisonous Articles.

*Limitation on Number of "Units."*—Since no carrier by rail express, motor truck, or air is permitted to carry more than 40 units and since surface carriers are prohibited from storing or stowing more than 40 units in any location, consignments should not be offered for shipment that cannot be accepted by a carrier because of such quantity limitations. (See ICC 75.655 (j) (3); 77.841 (d) (2); CAB 49.54 (c); USCG 146.25-45 (g).)

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\*All reference in this Chapter to Regulations refer to the appropriate Interstate Commerce Commission, Civil Aeronautics Board and U. S. Coast Guard Regulations.

*Accident, Leakage, Spillage, or Sifting.*—In cases of accident, leakage, spillage, or sifting, the carrier is usually required to notify the shipper and/or the proper authorities. The shipper may be required to render assistance in removing or disposing of the material and in decontaminating equipment or property. (See, for example, ICC 74.532 (j) (3); 75.655 (j) (7); 77.860 (c); CAB 49.55 (a) and (b); USCG146.25-50 (b).)

*Aircraft Engaged Principally in Transportation of Radioactive Materials.*—If any aircraft is engaged principally or entirely in the transportation of radioactive materials, it is the responsibility jointly of the shipper and the carrier to monitor all personnel involved so that the accepted limits of personnel radiation exposure are not exceeded (CAB 49.55 (d).)

*Shipments of Radioactive Materials.*—The shipper should notify the receiver of any shipment of radioactive materials, giving the following information: (1) date of shipment, (2) expected date of arrival, (3) method of transportation, and (4) description of material, packaging, etc. This information should be sent to reach the consignee before or at the time of arrival of the shipment.

It is suggested that shippers will find it advantageous to keep complete records of all shipments covered by these regulations. Such records should cover the following items: (1) description and quantities of material; (2) radiation measurements and instrumentation used; and (3) labels or placards affixed.

*Violations of Regulations.*—Shipments received by the consignee which appear to have been made in violation of regulations should be reported by consignee through normal contractual channels. (See ICC 73.11.)

*Permits.*—The several regulatory agencies can, within their discretion, issue special permits to cover shipments which do not meet the requirements of their regulations. AEC contractors, planning shipments not covered by the regulations or the use of shipping containers not provided for in the regulations, should submit a permit application through regular contractual channels to the Operations Office.

The application should include the following information:

Consignee and destination.

Method of shipment.

Description of material and quantity.

Date.

Gross weight of material.

Type of container (a drawing, sample or model should be submitted in the case of a new type of container for which a permit is being requested).

Radiation—Group classification (I, II, or III).

A. At surface.

B. Radiation units.

Labels used.